National Aeronautics and Space Administration

NAC Human Exploration and Operations Committee

Mr. Richard Kohrs, Chair

July 26, 2012

Agenda – July 23, 2012

***Status of International Space Station and Plans for Intravehicular Activity/Extravehicular Activity Environmental Control and Life Support Systems**
Dan Hartman

***Space Launch System/Orion**
William Hill

Status of Mars Program Planning Group
Orlando Figueroa and Michele Gates

Joint Robotic Precursor Activities
Victoria Friedensen/Mike Wargo

Status of Forming Subcommittee on Space and Life Science/ Center for Advancement of Science in Space (CASIS)
D. Marshall Porterfield

Agenda – July 24, 2012

Status of the Human Exploration and Operations Mission Directorate
Bill Gerstenmaier

Commercial Orbital Transportation Services/Commercial Crew Development
Phil McAlister

Overview of Contracting Options
William McNally

Committee Members

- **Present**
  - Richard "Dick" Kohrs, Chair
  - Bohdan "Bo" Bejmuk, Vice Chair
  - Shannon Bartell
  - Nancy Ann Budden
  - Stephen "Pat" Condon
  - Tommy Holloway
  - David Longnecker
  - Richard "Dick" Malow
  - James "Jim" Odom

- **Not present**
  - Leroy Chiao
  - Joseph "Joe" Cuzzupoli
  - Robert "Bob" Sieck

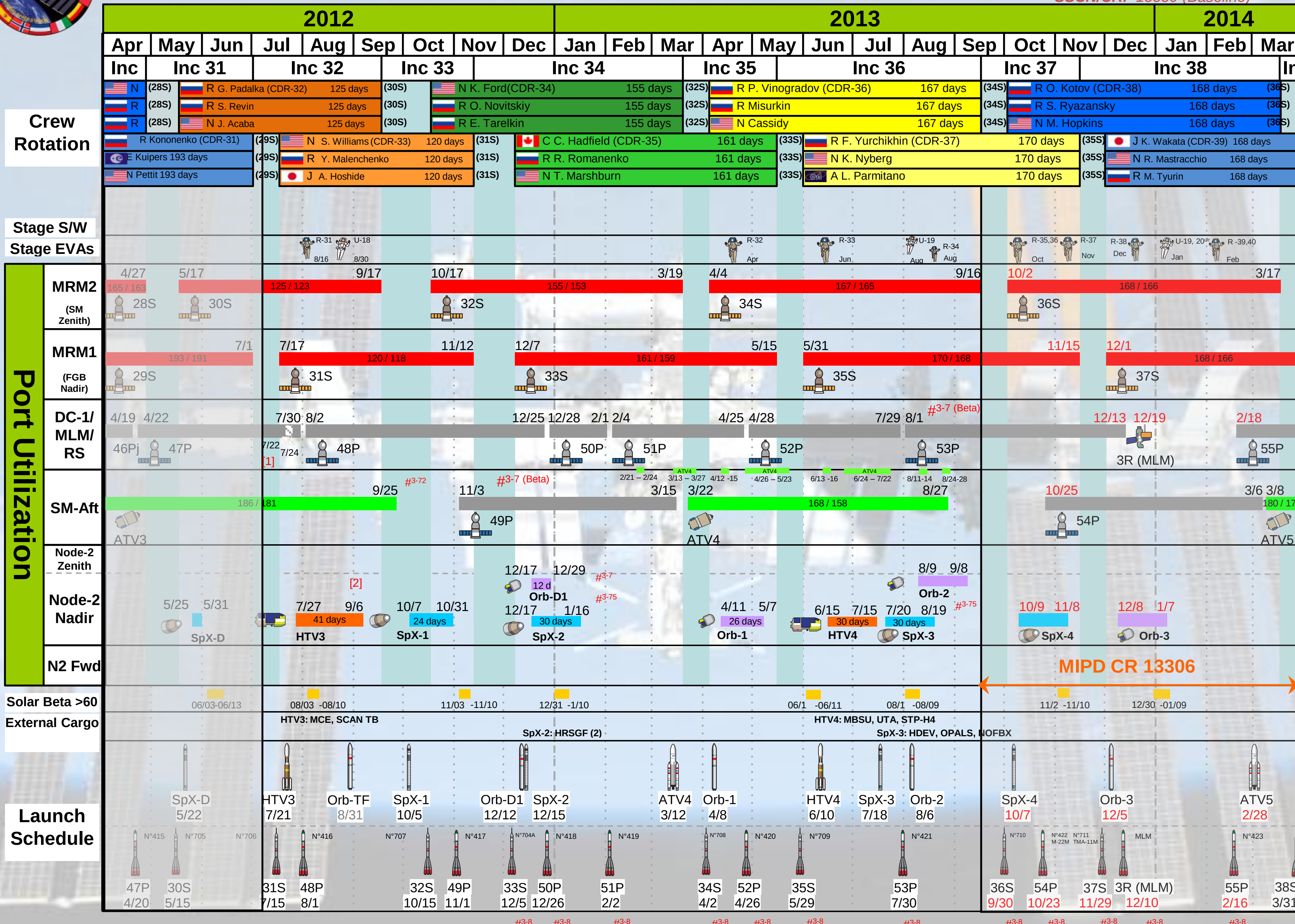
International Space Station Program Status

Dan Hartman
Manager, Operations Integration
ISS Program

ISS Flight Plan
Flight Planning Panel (FPP)
(Pre-decisional, For Internal Use, For Reference Only)

For current baseline refer to SSP 54100 Multi-Increment Planning Document (MIPD)

NASA Official: John Coggeshall
Prepared by: Scott Paul
Chart Updated: July 11, 2012
SSCN/CR: 13330 (Baseline)

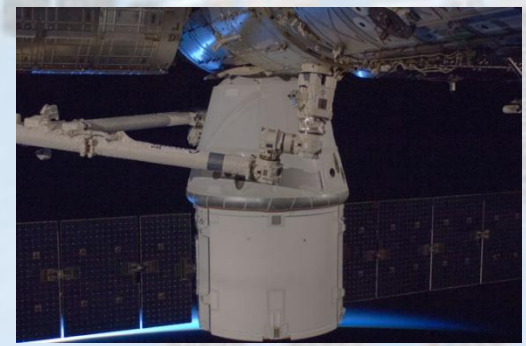


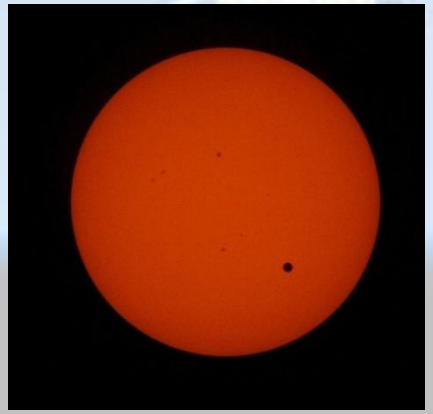
Recent Mission Accomplishments thru June 2012 (last 4 months)

- Successful Vehicle traffic at the ISS
  - March/April : ATV-3 dock 3/28, 46P undock 4/19, 47P docking 4/22, 28S undock 4/27
  - May/June : 30S Docking 5/19, SpaceX Demo berthing 5/25, SpaceX Demo unberth 5/31, 29S undock 6/30
  - July 17 31S docking
- Successful demonstration of SpaceX Demo vehicle objectives
  - Track and capture, berthing, cargo operations, unberth and release of first commercial vehicle to the ISS.
- Averaged 35 hours/week for research last Increment
  - Continued checkout of Robonaut
  - Robotic Refueling Mission (RRM) operations part 2
  - AMS detected 19 billionth cosmic particle
- Reacted to several system anomalies (JEM low temp pump, CDRA sensors and valves, Water Processor leak, GPS box failures)

Expedition 31 Crew

SpaceX Dragon, berthed at N2 Nadir



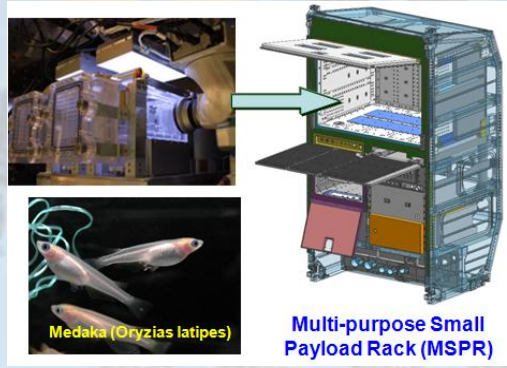


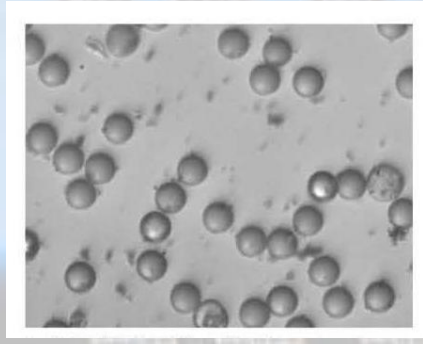
Transit of Venus as seen by the ISS crew.

Mission Objectives July 2012 – October 2012

- **Support upcoming vehicle traffic : 47P undocking, re-rendezvous, docking, and undocking, 48P docking, HTV3 berthing, 30S undock, HTV-3 unberth, ATV-3 undock, SpaceX-1 berthing, 32S docking**
- **Perform RS EVA #31 (MMOD shields on SM, launch Spherical Satellite, collect [CKK] and Biorisk) and USOS EVA #18 (R&R MBSU1, route MLM cables, install PMA2 cover), both scheduled in August**
- **Transition to the WRS Water Recovery System (WRS) re-usable Advanced Recycle Filter Tank Assembly (ARFTA), which reduces need for delivery and disposal of consumables for nominal operations**
- **New science delivered on HTV3 and 48P**
  - **Advanced Colloids Experiment-1 (ACE-1)**
  - **Aquatic Habitat**
  - **ISS SERVIR Environmental Research and Visualization System (ISERV)**
  - **Multi-mission Consolidated Equipment (MCE)**
  - **Plate Reader**
  - **Space Communications and Navigation (SCAN) Testbed**
  - **Small Sat Deploy Demo**
  - **YouTube Space Lab**
  - **Spacecraft Single Event Environments at High Shielding Mass (HiMassSEE): HiMassSEE**
  - **Radiation Environment Monitor (REM)**

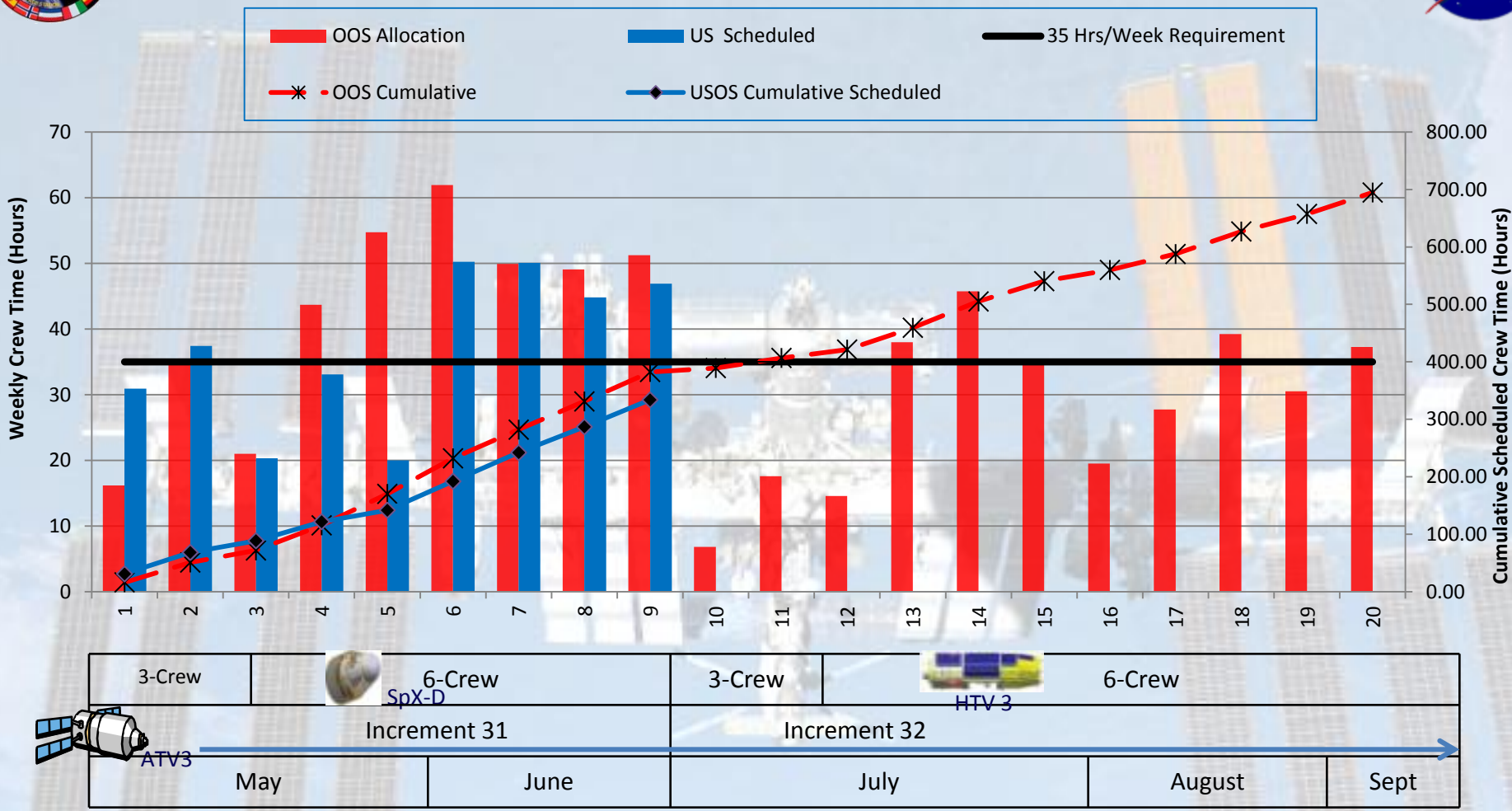
SCAN testbed





ACE-1

Increment 31 / 32 Utilization Crew Time



Week 9 of 20, 45% through the Increment

USOS Allocation (IDRD) : 686 Hours
USOS Actuals : 334 Hours

Total USOS Average Per week : 37.1 Hours

ISS Research Statistics: Expeditions 31/32 (Working data as of May 31, 2012)

Expeditions 31/32

201 Investigations

- 123 new investigations
- 82 NASA-led investigations
- 119 International-led investigations
- Over 400 Investigators represented
- Over 500 scientific results publications (Exp 0–present)

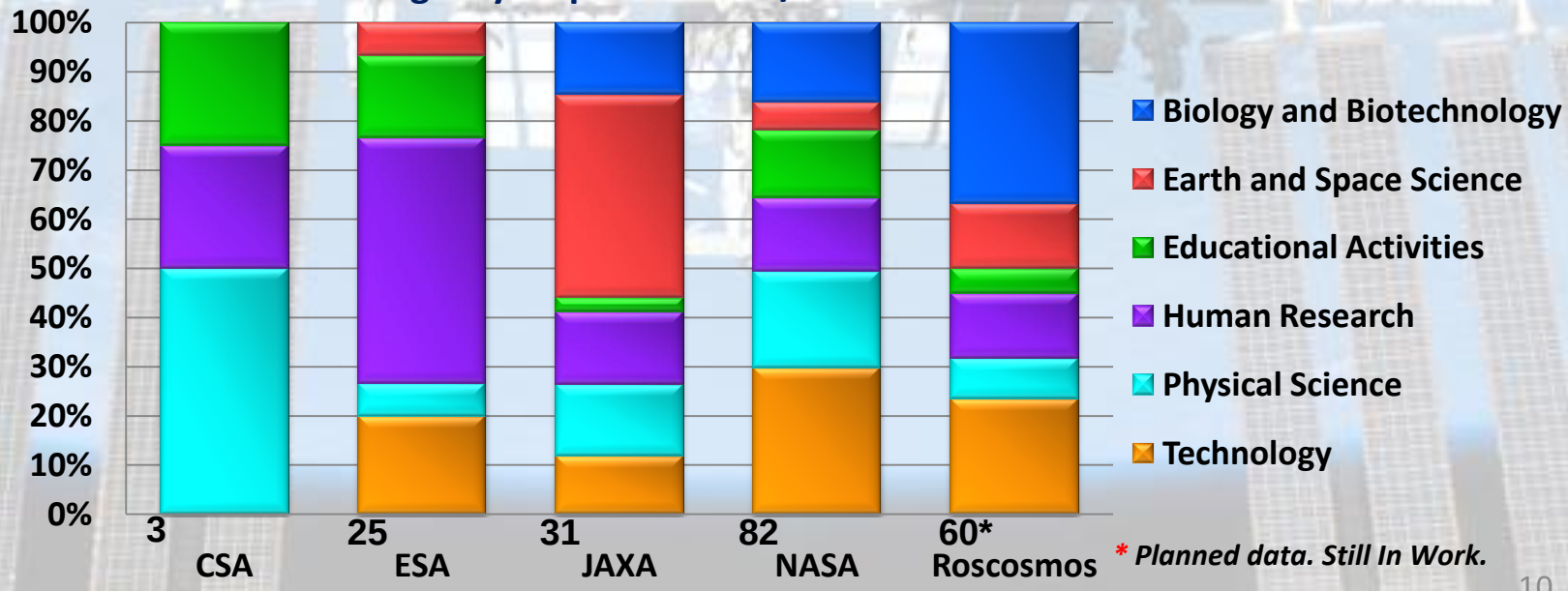
Expeditions 0 – 28

- 1251 Investigations
  - 475 NASA-led investigations
  - 776 International-led investigations
  - > 1300 scientists served

Expeditions 29/30

- 191 Investigations
  - 85 NASA-led investigations
  - 106 International-led investigations
  - > 400 scientists served

Research Disciplines of ISS Investigations By Partner Agency: Expeditions 31/32



** Planned data. Still In Work.*

SpaceX Demonstration

SpaceX Demonstration Mission

- **SpX Demo Mission successfully met all necessary ISS cargo demonstration activities**
  - Launched successfully on 5/22
  - Completed successful ISS Flyunder on 5/23
    - All free flyer demonstration requirements fully met
  - Performed berthing to ISS on 5/25
  - Delivered 525 kg of upmass to ISS and returned 665 kg of downmass from the ISS
  - Returned high priority ISS cargo including a Contingency Water Container – Iodine (CWCI) and a Space Integrated GPS (Global Positioning System)/INS (Inertial Navigation System) (SIGI)
  - Unberth conducted on 5/31 with de-orbit and splashdown successfully completed on same day
  - Retrieval of Dragon capsule from Pacific Ocean completed on 5/31
  - Early destow demonstration successfully completed on 6/2
  - Nominal cargo handover to CMC was completed from 6/13 – 6/15
  - Final Post Flight Report delivery is planned for early August (Return + 2 months)

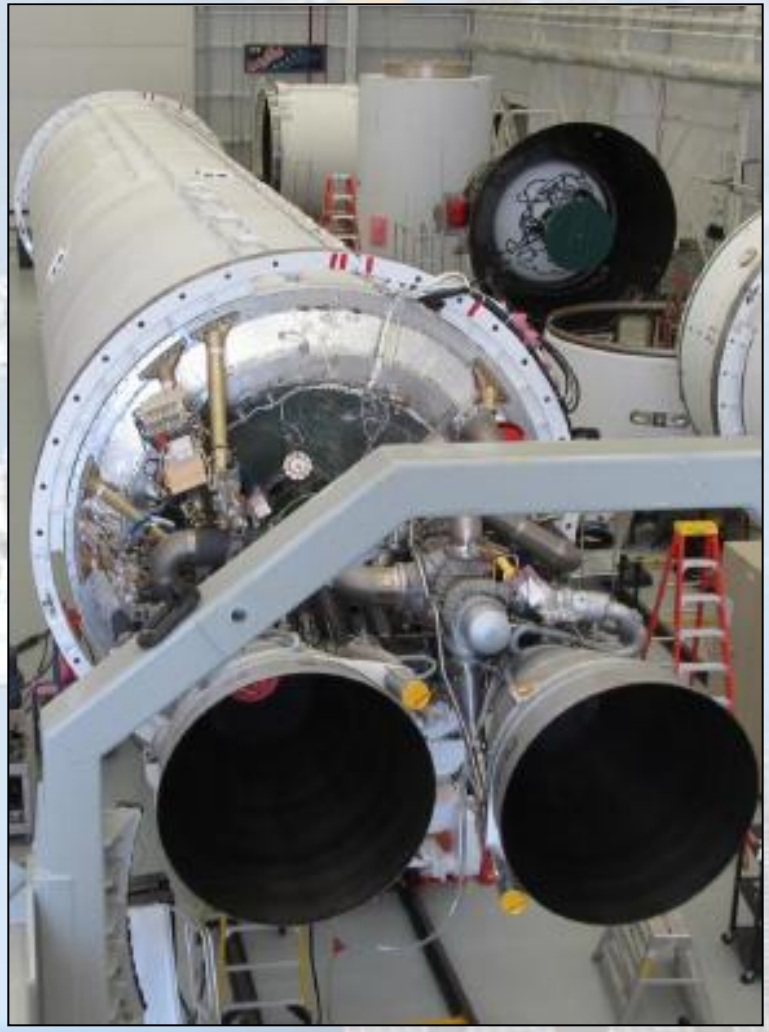
SpaceX Demo successfully launched from LC40 on 5/22

Dragon on the barge after being retrieved from Pacific Ocean on 5/31

Photo Credits: SpaceX

Orbital Demonstration Mission

- **Orbital Test/Demo Missions**
  - Completion and turnover for operations of the Wallops Flight Facility (WFF) launch pad is July
    - 5K Cold flowTest Readiness Review (TRR) Phase 1 completed at WFF on 5/15; Phase 2 closeout planned for 7/23
    - 5K test planned following pad handover; 7K hot fire test planned for 8/29
  - Test Flight vehicle:
    - Orbital projecting a NET 9/29 Test Flight launch of Anteras
    - Main Engine System Integration to Stage 1 Core has been completed
  - Demo:
    - ISS Program official launch date for Demo is 12/12, with Orbital readiness NET 11/22
    - Cygnus Service Module Final Integrated System Test (FIST) completion planned for mid-July
  - Safety Review Panel (SRP) Phase III meetings held on 5/23, 6/6, and 6/22 for the Collision Hazard Report
    - Additional reviews in July, with closeout in August
  - Software Stage Test (Joint Test 4) scheduled for 8/22-9/12 (dry run completed)
  - Joint Multi-Segment Training simulations on-going



Test Flight Core and Engines in HIF being prepped for Launch.

Photo Credits: OSC

ISS Top Program Risk Matrix (Post June 07, 2012 PRAB)

Corrective/Preventative Actions

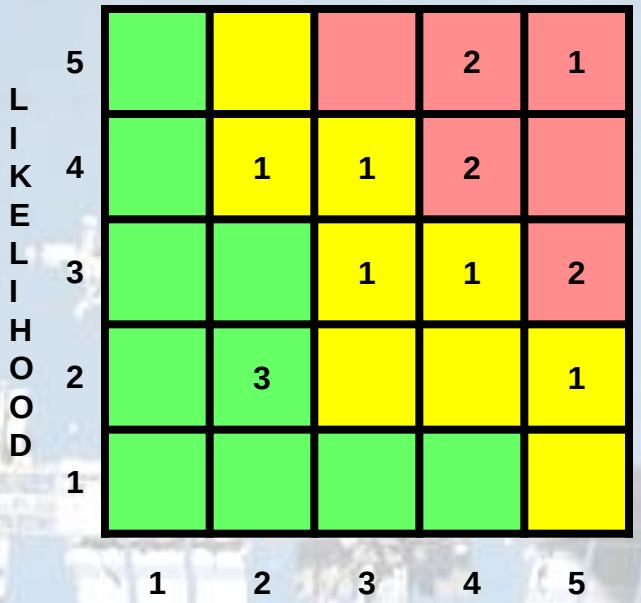
None

Watch Items

No Watch Items Elevated

Continual Improvement

None



Low	Medium	High	
C – Cost	S – Schedule	T – Technical	Sa – Safety

Top Program Risk (TPR)

Added 6370

Rescored 2810 & 6198

Risks (L x C)

Score: 5 x 5
- 6352 - Overlap in Commercial Crew & Soyuz Launch Services - (OH) - (C,S,T,Sa)

Score: 5 x 4
- 6344 - ISS Operations Budget Reduction - (OH) - (C)
- 6370 - ISS Pension Harmonization - (OH) - (C)

Score: 4 x 4
- 5456 - ISS Budget and Schedule - (OH) - (C,S,T)
- 6169 - Visual Impairment / Intracranial Pressure - (SA) - (C,S,T,Sa)

Score: 3 x 5
- 5688 - ISS Solar Array Management Operations Controls and Constraints - (OM) - (C,S,T,Sa)
- 2810 - Russian Segment (RS) capability to provide adequate MM/OD protection - (OM) - (C,S,T,Sa)

Score: 3 x 4
- 5184 - USOS Cargo Resupply Services (CRS) Upmass Shortfall - 2010 through 2016 - (ON) - (C,S,T,Sa)

Score: 4 x 3
- 5269 - The Big 12 Contingency EVA's - (OB) - (S,T,Sa)

Score: 2 x 5
- 6262 - Potential USOS Nitrogen and Oxygen Resupply Shortfall - (OB) - (C,S,T,Sa)

Score: 3 x 3
- 6096 - Urine Processing Function - (OB) - (T)

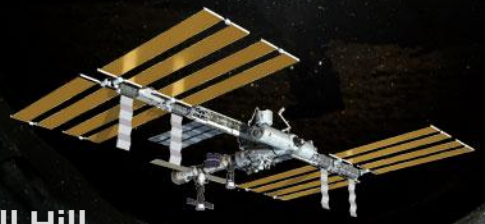
Score: 4 x 2
- 6347 - Temporary Urine and Brine Stowage System Catastrophic leak of a Tox-2 Fluid - (OB) - (S,T,Sa)

Score: 2 x 2
- 6032 - On-Orbit Stowage Short-Fall (Pressurized Volume) - (OC) - (T,Sa)
- 6093 - Oxygen Processing Function - (OB) - (C,T)
- 6198 - ODAR HRCS/ICU Cost Growth - SSCN#11372 - (OD) - (C,S,T)

National Aeronautics and Space Administration

Exploration Systems Development Briefing to the NASA Advisory Council

Status of ESD, Orion, SLS, and GSDO



Bill Hill

23 July 2012

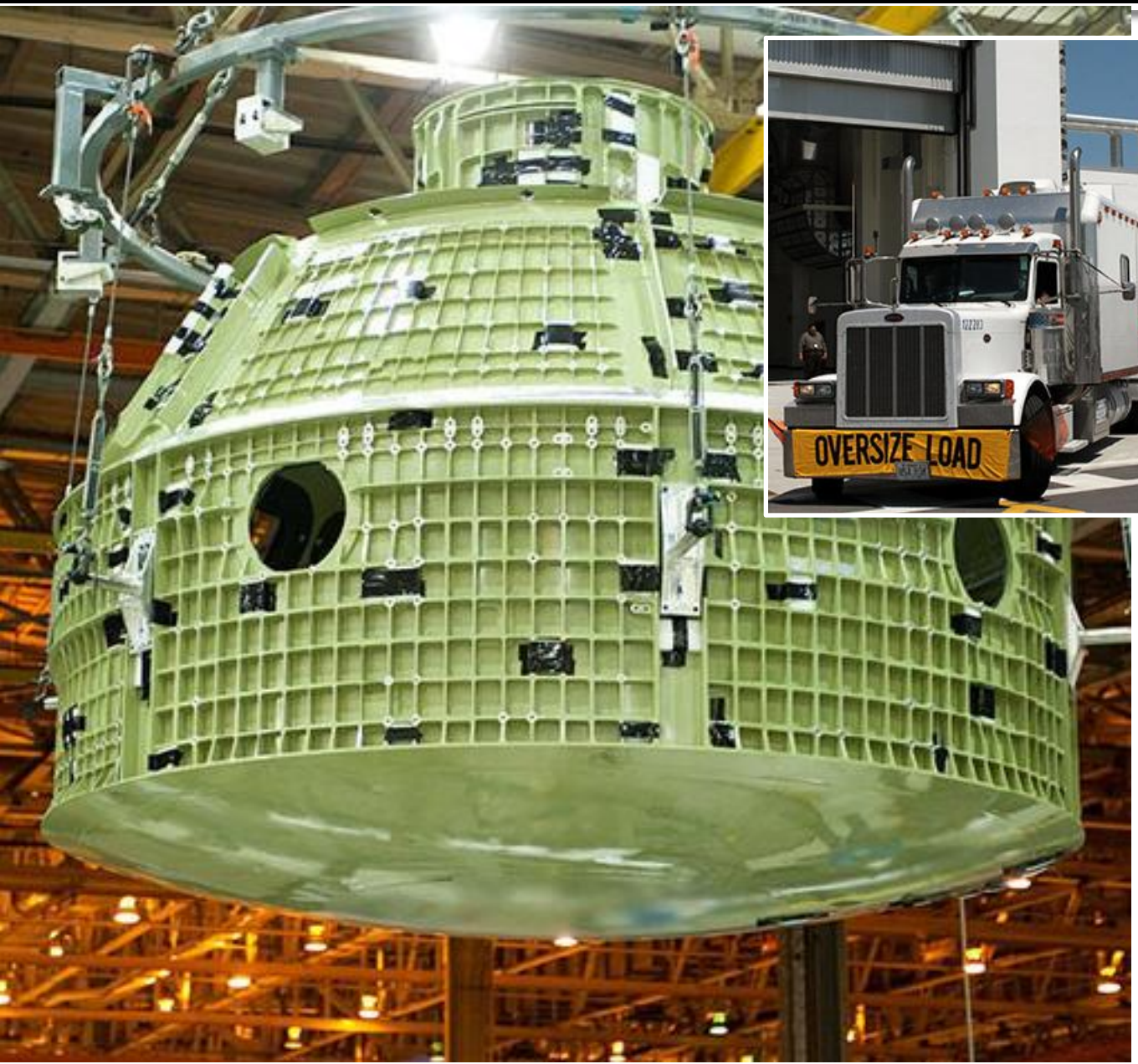
Orion/SLS Plan

- **2014 Exploration Flight Test 1**
  - Launch Orion capsule on Delta 4 Heavy with delta upper stage
  - 2 hr mission to demonstrate 80% deep space return entry velocity
  - No crew

- **2017 Exploration Mission (EM-1)**
  - 70 metric ton
  - Lunar fly-by
  - No crew

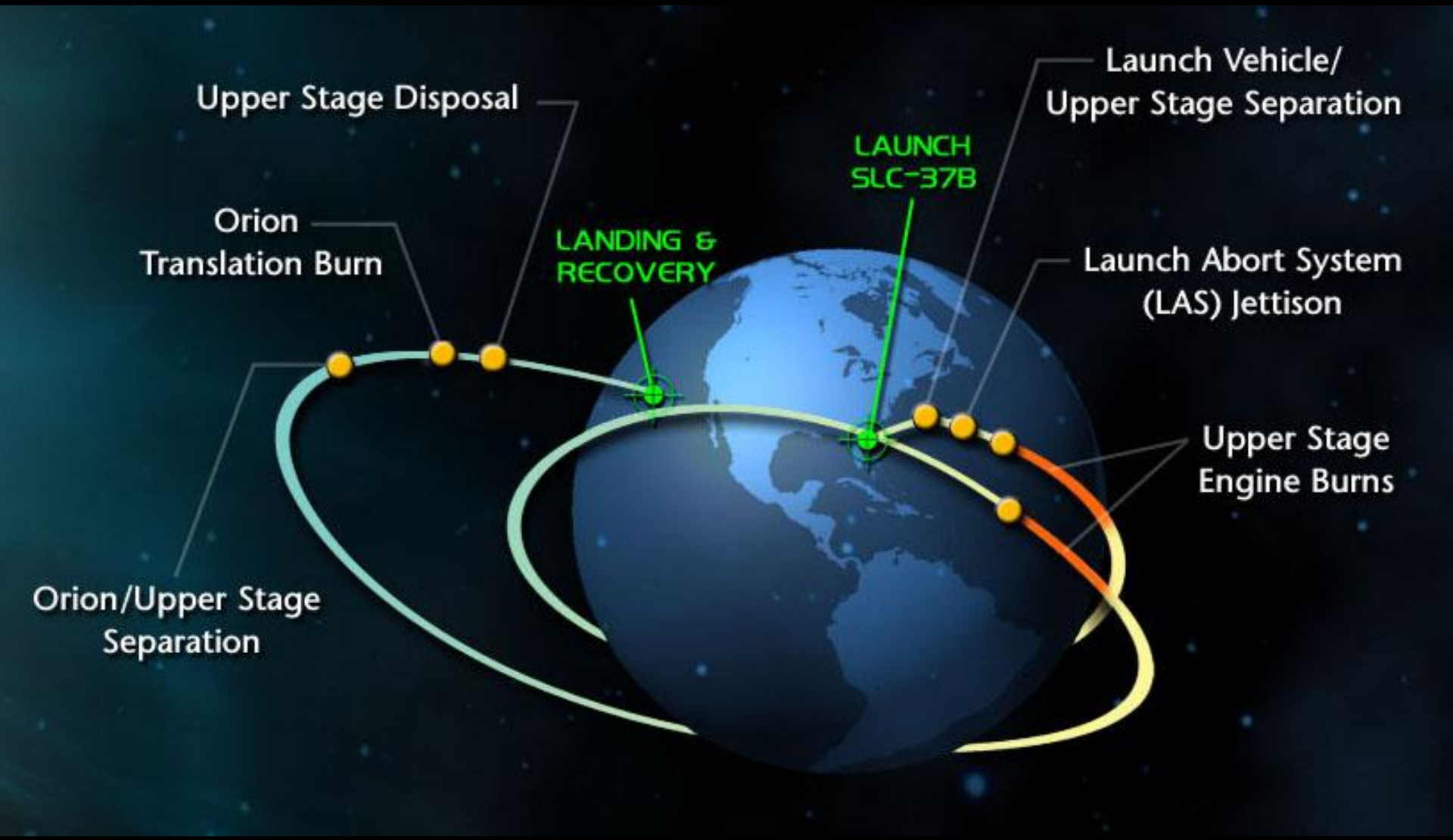
- **2021 Exploration Mission (EM-2)**
  - 70 metric ton
  - Mission TBD
  - Crewed

Orion EFT-1 Updates



Orion EFT-1 in route to NASA's Kennedy Space Center

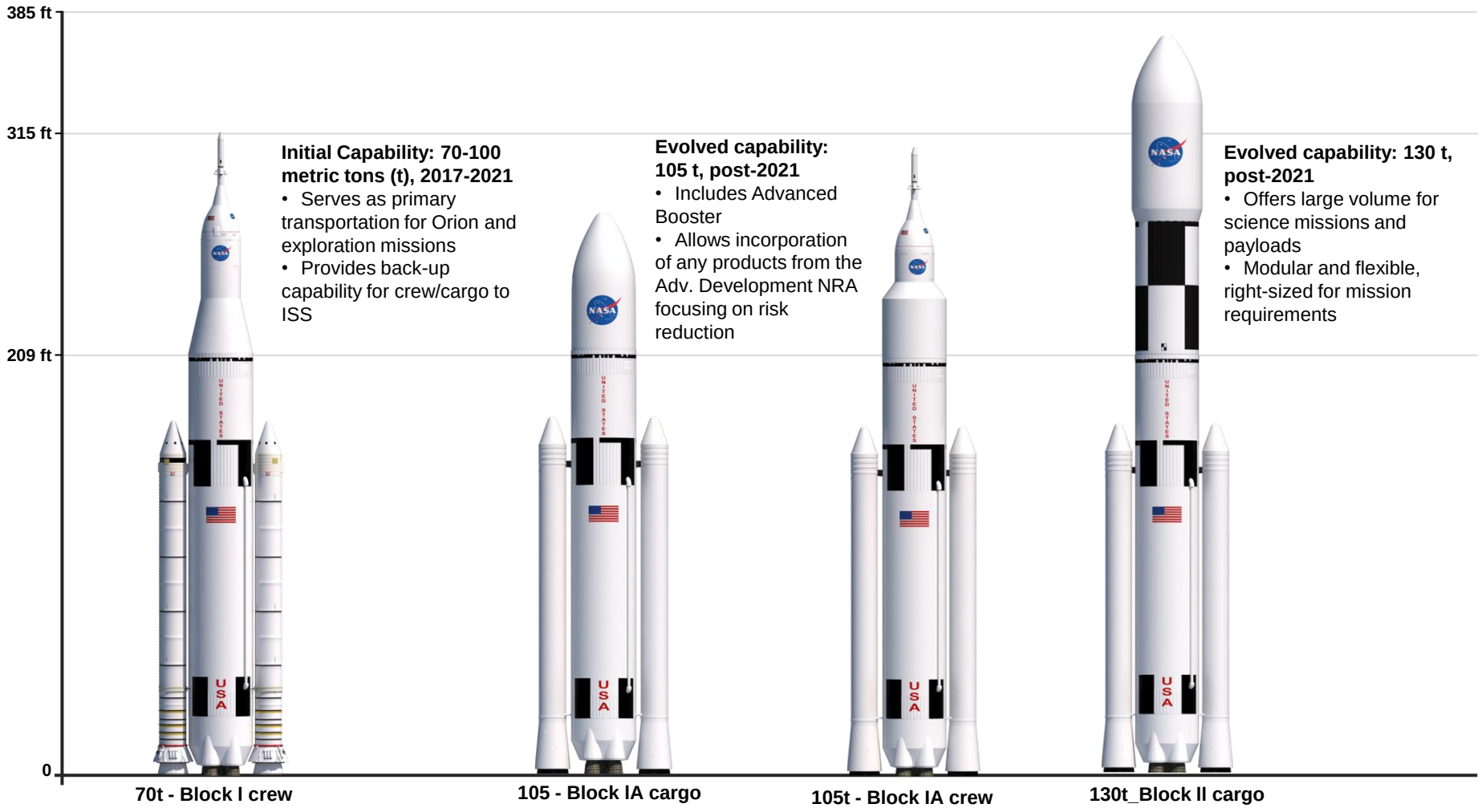
Exploration Flight Test 1



SLS 70 Metric Tons: First Flight 2017

INITIAL CAPABILITY, 2017–21

SLS
Evolvable Configurations and Characteristics

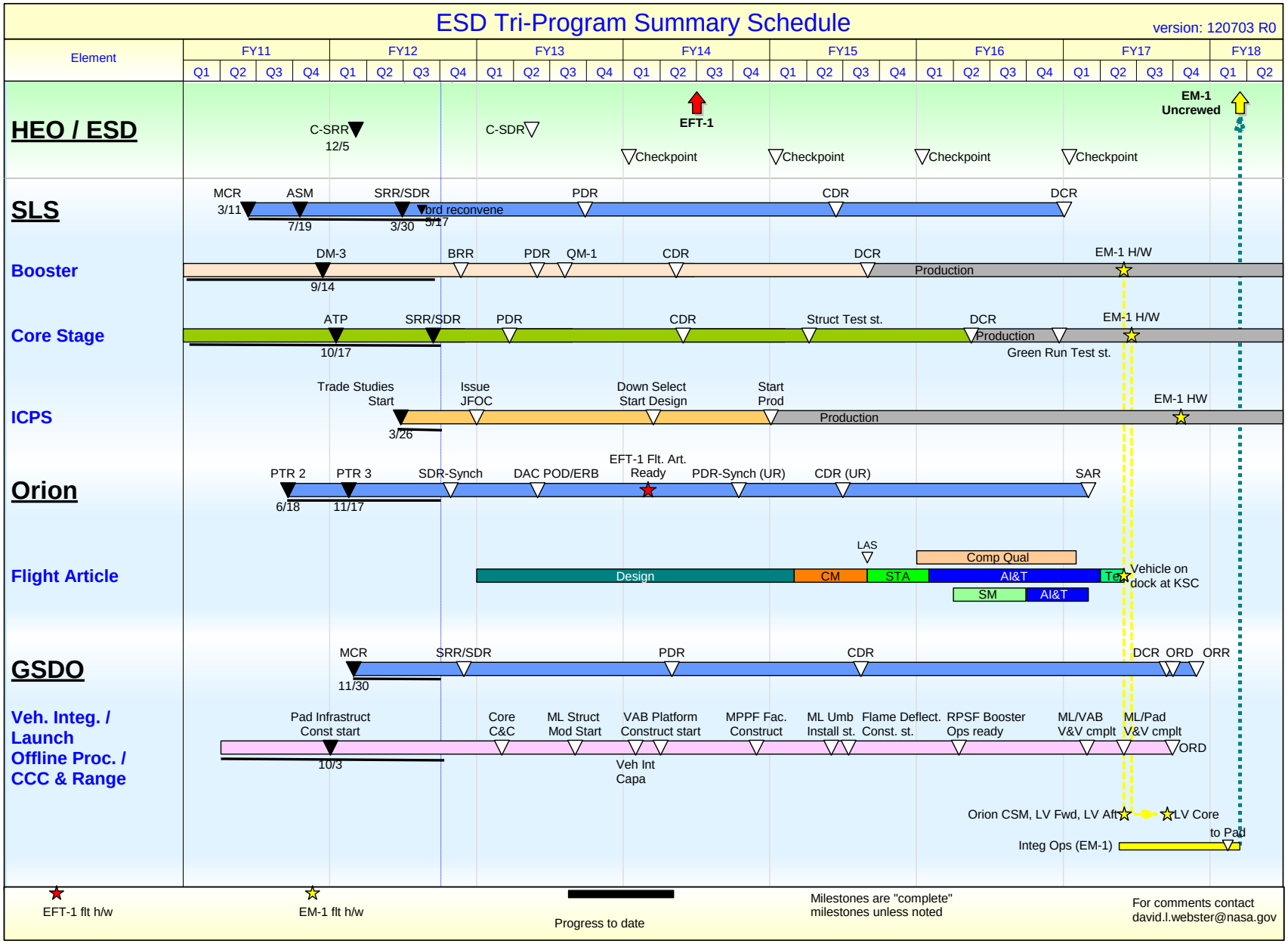


SLS First Flight (Non-crewed) in 2017

SLS Summary by Element:
Risk Reduction Incorporated in Design

- **Boosters (3-phased approach)**
  - Phase I: 5-segment Solid Rocket Booster in-scope modification to existing Ares contract with ATK for initial flights through 2021
  - Phases II and III: Advanced Boosters
    - II: Engineering demonstration and risk reduction via NASA Research Announcement (NRA): Full and Open Competition in FY12; award by FY13
    - III: Design, Development, Test & Evaluation (DDT&E): Full and Open Competition (RFP target FY15)
- **Stages**
  - Core/Upper Stage: Justification for Other Than Full and Open Competition (JOFOC) to Boeing, modifying current Ares Upper Stage contract
  - Instrument Unit Avionics: In-scope modification to existing Ares contract with Boeing; consolidated with Stages contract to Boeing
- **Engines**
  - Core Stage Engine: 4 RS-25 engines per core; JOFOC to existing Space Shuttle contract with Pratt & Whitney Rocketdyne (PWR)
  - Upper Stage Engine: J-2X in-scope modification to existing Ares contract with PWR
  - Future Core Stage Engine: Separate contract activity to be held in the future

- **Spacecraft and Payload Adapter and Fairing**
  - Initial design: Adapter and Fairing design and development in-house through early design phase
  - Fairing Full and Open Competition planned for FY13


ESD Tri-Program Summary Schedule
version: 120703 R0
Element
FY11
FY12
FY13
FY14
FY15
FY16
FY17
FY18
Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2
HEO / ESD
C-SRR
12/5
C-SDR
EFT-1
Checkpoint
Checkpoint
Checkpoint
Checkpoint
EM-1
Uncrewed
SLS
MCR
3/11
ASM
7/19
SRR/SDR
3/30
bord reconvene
5/17
PDR
CDR
DCR
Booster
DM-3
9/14
BRR
PDR
QM-1
CDR
DCR
Production
EM-1 H/W
Core Stage
ATP
10/17
SRR/SDR
PDR
CDR
Struct Test st.
DCR
Production
Green Run Test st.
EM-1 H/W
ICPS
Trade Studies
Start
3/26
Issue
JFOC
Down Select
Start Design
Start
Prod
Production
EM-1 HW
Orion
PTR 2
6/18
PTR 3
11/17
SDR-Synch
DAC POD/ERB
EFT-1 Flt. Art.
Ready
PDR-Synch (UR)
CDR (UR)
SAR
Flight Article
LAS
Comp Qual
Design
CM
STA
AI&T
Test
Vehicle on
dock at KSC
SM
AI&T
GSDO
MCR
11/30
SRR/SDR
PDR
CDR
DCR
ORD
ORR
Veh. Integ. /
Launch
Offline Proc. /
CCC & Range
Pad Infrastruct
Const start
10/3
Core
C&C
ML Struct
Mod Start
VAB Platform
Construct start
Veh Int
Capa
MPPF Fac.
Construct
ML Umb
Install st.
Flame Deflect.
Const. st.
RPSF Booster
Ops ready
ML/VAB
V&V cmplt
ML/Pad
V&V cmplt
ORD
Orion CSM, LV Fwd, LV Aft
LV Core
to Pad
Integ Ops (EM-1)
EFT-1 flt h/w
EM-1 flt h/w
Progress to date
Milestones are "complete"
milestones unless noted
For comments contact
david.l.webster@nasa.gov

Discussion

- Silent on contract type
- Plan to review certification/verification of CCDEV contractor and NASA activity at next meetings
- Briefing from outreach at next meeting
- Pursue civilian tourist on Commercial Crew
- Committee will review 7120.5 and discuss at next meeting

Recommendation to the NAC

- **Name of Committee:**
  NAC HEO Committee

- **Short Title of Recommendation:**
  Systems Integration

- **Recommendation:**
  A small team of experienced integrators, led by an empowered, accountable and responsible leader, should be established to ensure adequate integration of the SLS, Orion and Ground System programs.

- **Major Reason:**
  Integration between SLS, Orion, and Ground Systems programs requires definition and implementation.

- **Consequence of no action:**
  Due to the lack of adequate integration of the three programs, design and configuration disconnects will be identified late resulting in cost overruns, schedule slips and risk to mission.